REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add case outline Y. Add vendor CAGE 69210. Editorial changes throughout.	90-08-07	M. A. FRYE
B	Make changes to the line regulation and thermal regulation tests in accordance with NOR 5962-R150-92.	92-03-25	M. A. FRYE
C	Add case outline Z and make corrections to case outline Y terminal connections under figure 2 in accordance with NOR 5962-R091-93.	93-03-15	M. A. FRYE
D	Add vendor CAGE 0EU86, case outline 2, and terminal connections under figure 2 in accordance with NOR 5962-R001-95.	94-10-21	M. A. FRYE
E	Add radiation hardness requirements. Redrawn. - rrp	00-03-24	R. MONNIN
F	Replace reference to MIL-STD-973 with reference to MIL-PRF-38535. Update the descriptive designators under 1.2.3 and delete figure 1. - ro	08-05-16	R. HEBER
G	Add case outline U, MSFM1-P3. Make changes to 1.2.3, 1.3, 3.5, and figure 1. - ro	09-04-28	J. RODENBECK

THE ORIGINAL FIRST SHEET OF THIS DRAWING HAS BEEN REPLACED.

REV																			
SHEET																			
REV																			
SHEET																			
REV STATUS				REV			G	G	G	G	G	G	G	G	G	G			
OF SHEETS				SHEET			1	2	3	4	5	6	7	8	9	10			

PMIC N/A

PREPARED BY
GARY ZAHN

DEFENSE SUPPLY CENTER COLUMBUS
COLUMBUS, OHIO 43218-3990
http://www.dscc.dla.mil

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

CHECKED BY
RAY MONNIN

APPROVED BY
MICHAEL A. FRYE

DRAWING APPROVAL DATE
89-06-13

MICROCIRCUIT, LINEAR, ADJUSTABLE, POSITIVE, LOW DROPOUT, VOLTAGE REGULATOR, MONOLITHIC SILICON

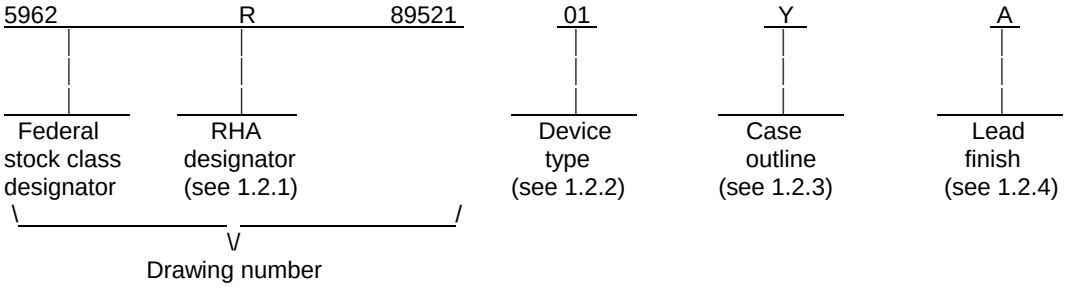
REVISION LEVEL	SIZE	CAGE CODE	
G	A	**67268**	**5962-89521**

SHEET 1 OF 10

1. SCOPE

1.1 Scope. This drawing describes device requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A.

1.2 Part or Identifying Number (PIN). The complete PIN is as shown in the following example:



1.2.1 RHA designator. RHA marked devices shall meet the MIL-PRF-38535 or MIL-PRF-38535, Appendix A specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) identify the circuit function as follows:

Device type	Generic number	Circuit function
01	1084	5.0 A adjustable positive regulator

1.2.3 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
U	MSFM1-P3	3	TO-257 single row flange mounted with isolated tab and glass seal
X	MBFM1-P2	2	TO-3 flange mount
Y	MSFM3-P3	3	TO-258 single row flange mounted with isolated tab and glass seal
Z	MSFM3-P3	3	TO-258 single row flange mounted with non-isolated tab and glass seal
2	CQCC1-N20	20	Square leadless chip carrier

1.2.4 Lead finish. The lead finish is as specified in MIL-PRF-38535, appendix A.

1.3 Absolute maximum ratings.

Input to output voltage differential	35 V
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Power dissipation (P_D)	Internally limited
Output current (I_{OUT})	5.0 A
Junction temperature (T_J)	+150°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case U	4.0°C/W
Cases X and Y	3.0°C/W
Case Z	2.3°C/W
Case 2	20°C/W

1.4 Recommended operating conditions.

Input to output voltage differential	25 V dc
Output current (I_{OUT})	10 mA
Full load current (I_{FL})	3.0 A
Ambient operating temperature range (T_A)	-55°C to +125°C

1.5 Radiation features:

Maximum total dose available (dose rate = 50 – 300 rads(Si) / s)	100 Krads (Si) 1/

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-38535 - Integrated Circuits, Manufacturing, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-883 - Test Method Standard Microcircuits.
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-103 - List of Standard Microcircuit Drawings.
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

1/ These parts may be dose rate sensitive in a space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions specified in MIL-STD-883, method 1019, condition A.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein. Product built to this drawing that is produced by a Qualified Manufacturer Listing (QML) certified and qualified manufacturer or a manufacturer who has been granted transitional certification to MIL-PRF-38535 may be processed as QML product in accordance with the manufacturers approved program plan and qualifying activity approval in accordance with MIL-PRF-38535. This QML flow as documented in the Quality Management (QM) plan may make modifications to the requirements herein. These modifications shall not affect form, fit, or function of the device. These modifications shall not affect the PIN as described herein. A "Q" or "QML" certification mark in accordance with MIL-PRF-38535 is required to identify when the QML flow option is used.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535, appendix A and herein.

3.2.1 Case outlines. The case outlines shall be in accordance with 1.2.2 herein.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.3 Radiation exposure circuit. The radiation exposure circuit shall be as specified on figure 2.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full ambient operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-PRF-38535, appendix A. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked. For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device. For RHA product using this option, the RHA designator shall still be marked.

3.5.1 Certification/compliance mark. A compliance indicator “C” shall be marked on all non-JAN devices built in compliance to MIL-PRF-38535, appendix A. The compliance indicator “C” shall be replaced with a "Q" or "QML" certification mark in accordance with MIL-PRF-38535 to identify when the QML flow option is used.

3.6 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.6 herein). The certificate of compliance submitted to DSCC-VA prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-PRF-38535, appendix A and the requirements herein.

3.7 Certificate of conformance. A certificate of conformance as required in MIL-PRF-38535, appendix A shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change. Notification of change to DSCC-VA shall be required for any change that affects this drawing.

3.9 Verification and review. DSCC, DSCC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
Reference voltage	V_{REF}	$(V_{IN} - V_{OUT}) = 3.0$ V,		1	01	1.238	1.262	V
		$I_{OUT} = 10$ mA	M,D,P,L,R	1		1.238	1.262	
		$1.5 V \le (V_{IN} - V_{OUT}) \le 25$ V, $10 mA \le I_{OUT} \le 3.0$ A		1,2,3		1.225	1.270	
			M,D,P,L,R	1		1.225	1.270	
Line regulation 3/	$\Delta V_{OUT} / \Delta V_{IN}$	$1.5 V \le (V_{IN} - V_{OUT}) \le 15$ V,		1,2,3	01		0.2	%
		$I_{OUT} = 10$ mA	M,D,P,L,R	1			0.2	
		$15 V \le (V_{IN} - V_{OUT}) \le 35$ V,		1,2,3			0.5	
		$I_{OUT} = 10$ mA	M,D,P,L,R	1			0.5	
Load regulation 3/	$\Delta V_{OUT} / \Delta V_{IN}$	$(V_{IN} - V_{OUT}) = 3.0$ V, $10 mA \le I_{OUT} \le 3.0$ A		1	01		0.3	%
			M,D,P,L,R	1			0.3	
		$(V_{IN} - V_{OUT}) = 3.0$ V, $10 mA \le I_{OUT} \le 3.0$ A		2,3			0.4	
Dropout voltage	V_{DO}	$I_{OUT} = 3.0$ A, $\Delta V_{REF} = 1\%$		1,2,3	01		1.5	V
			M,D,P,L,R	1			1.5	
Thermal regulation	---	30 ms pulse, $T_A = +25°C$		1	01		0.015	% / W
			M,D,P,L,R	1			0.015	
Ripple rejection	$\Delta V_{IN} / \Delta V_{OUT}$	f = 120 Hz, $C_{ADJ} = 25$ µF, $C_{OUT} = 25$ µF (tantalum), $I_{OUT} = 3.0$ A, $(V_{IN} - V_{OUT}) = 3.0$ V		4,5,6	01	60		dB
			M,D,P,L,R	4		60		
Adjust pin current	I_{ADJ}	$1.5 V \le (V_{IN} - V_{OUT}) \le 25$ V, $I_{OUT} = 10$ mA,		1,2,3	01		120	µA
		$I_{OUT} = 3.0$ A	M,D,P,L,R	1			120	
Adjust pin current change	ΔI_{ADJ}	$10 mA \le I_{OUT} \le 3.0$ A, $1.5 V \le (V_{IN} - V_{OUT}) \le 25$ V		1,2,3	01		5.0	µA
			M,D,P,L,R	1			5.0	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
Minimum load current	I_{MIN}	$(V_{IN} - V_{OUT}) = 25$ V		1,2,3	01		10	mA
			M,D,P,L,R	1			10	
Current limit	I_{LIM}	$(V_{IN} - V_{OUT}) \le 5.0$ V		1,2,3	01	5.5		A
			M,D,P,L,R	1		5.5		
		$(V_{IN} - V_{OUT}) = 25$ V		1,2,3		0.3		
			M,D,P,L,R	1		0.3		
Temperature stability 4/	$\Delta V_{OUT} / \Delta T$	$-55°C \le T_J \le +125°C$		1,2,3	01		1.5	%
			M,D,P,L,R	1			1.5	
Long term stability 4/	$\Delta V_{OUT} / \Delta T$	$T_A = +125°C$, t = 1000 hours		2	01		1.0	%

1/ RHA devices supplied to this drawing have been characterized through all levels M, D, P, L, R of irradiation. However, this device is only tested at the "R" level. Pre and Post irradiation values are identical unless otherwise specified in Table I. When performing post irradiation electrical measurements for any RHA level, $T_A = +25°C$.

2/ These parts may be dose rate sensitive in a space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions specified in MIL-STD-883, method 1019, condition A.

3/ Line and load regulation are measured at a constant junction temperature using a low duty cycle pulse technique. Although power dissipation is internally limited, regulation is guaranteed up to the maximum power dissipation of 45 W. Power dissipation is determined by the input/output differential voltage and the output current. Guaranteed maximum power dissipation will not be available over the full input/output voltage range.

4/ Guaranteed, if not tested, to the limits specified.

Device type	01				
Case outlines	U	X	Y	Z	2
Terminal number	Terminal symbol				
1	ADJUSTMENT	ADJUSTMENT	ADJUSTMENT	ADJUSTMENT	NC
2	OUTPUT	V_{IN}	OUTPUT	OUTPUT	OUTPUT
3	V_{IN}	OUTPUT (CASE)	V_{IN}	V_{IN}	NC
4	---	---	NC	OUTPUT	ADJUSTMENT
5	---	---	---	---	NC
6	---	---	---	---	NC
7	---	---	---	---	NC
8	---	---	---	---	NC
9	---	---	---	---	NC
10	---	---	---	---	NC
11	---	---	---	---	V_{IN}
12	---	---	---	---	OUTPUT
13	---	---	---	---	NC
14	---	---	---	---	NC
15	---	---	---	---	V_{IN}
16	---	---	---	---	NC
17	---	---	---	---	NC
18	---	---	---	---	NC
19	---	---	---	---	NC
20	---	---	---	---	OUTPUT

NOTE: NC = No connection

FIGURE 1. Terminal connections.

Case Y

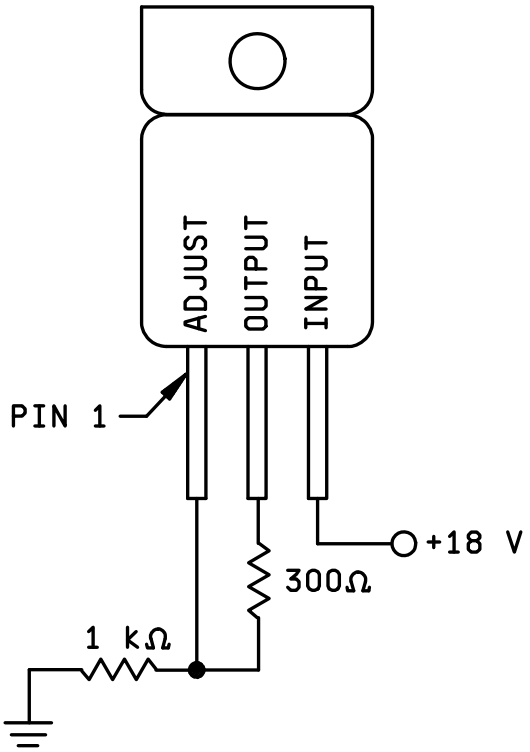


FIGURE 2. Radiation exposure circuit.

4. VERIFICATION

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.

(2) T_A = +125°C, minimum.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with method 5005 of MIL-STD-883 including groups A, B, C, and D inspections. The following additional criteria shall apply.

4.3.1 Group A inspection.

a. Tests shall be as specified in table II herein.

b. Subgroups 7, 8, 9, 10, and 11 in table I, method 5005 of MIL-STD-883 shall be omitted.

4.3.2 Groups C and D inspections.

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test conditions, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.

(2) T_A = +125°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.3.3 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels shall be as specified in MIL-PRF-38535 or MIL-PRF-38535, Appendix A. End-point parameters shall be as specified in table II herein.

4.3.3.1 Total dose irradiation testing. Total dose irradiation testing shall be performed in accordance with MIL-STD-883 method 1019, condition A and as specified herein.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table I)
Interim electrical parameters (method 5004)	1
Final electrical test parameters (method 5004)	1*, 2, 3, 4, 5, 6
Group A test requirements (method 5005)	1, 2, 3, 4, 5, 6
Groups C and D end-point electrical parameters (method 5005)	1
Group E end point electrical parameters (method 5005)	1, 4

* PDA applies to subgroup 1.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535, appendix A.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished using DD Form 1692, Engineering Change Proposal.

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus (DSCC) when a system application requires configuration control and the applicable SMD. DSCC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0544.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Columbus, Ohio 43218-3990, or telephone (614) 692-0547.

6.6 Approved sources of supply. Approved sources of supply are listed in MIL-HDBK-103. The vendors listed in MIL-HDBK-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DSCC-VA.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 09-04-28

Approved sources of supply for SMD 5962-89521 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38535 during the next revision. MIL-HDBK-103 and QML-38535 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DSCC-VA. This information bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535. DSCC maintains an online database of all current sources of supply at http://www.dscc.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-8952101UA	60264	MTLT1084QP
5962-8952101XA	60264	MTLT1084QK
	3/	SDP1084XMD
	3/	OM1840NKM/883B
	3/	LT1084MK/883
5962-8952101YA	60264	MTLT1084QW
	3/	SDP1084YMD
	3/	OM184SCM/883
	3/	FM184S8/883
5962-8952101ZA	3/	SDP1084ZDM
	3/	OM1840NCM
5962-89521012A	60264	MTLT1084QLS
	3/	AS1084EC/883C
5962R8952101YA	3/	OMR1840SCM/883B

1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the vendor to determine its availability.
2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.
3/ Not available from an approved source of supply.

Vendor CAGE number	Vendor name and address
60264	Minco Technology Labs, Inc. 1805 Rutherford Lane Austin, TX 78754-5101